



IETF 105

**Update on
draft-irtf-nwcrg-network-coding-satellites-05**

N. KUHN and E. LOCHIN

From *-04 to *-05

- **Since last IETF : WGLC process**
- **Comments from Lloyd Wood and John Border**
- **Rather than presenting a diff, this presentation presents *-05**

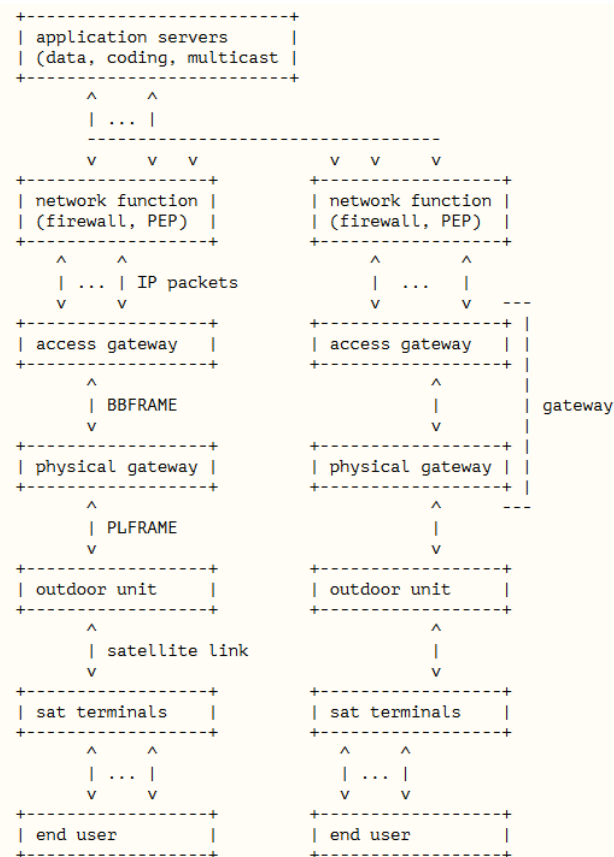
Abstract

- **Follows the taxonomy document [RFC8406]:**
 - coding as a linear combination of packets
 - operates above the network layer
- **Details a multi-gateway satellite system to identify use-cases where coding is relevant**
 - Cope from residual losses
 - Provide reliable multicast services
 - ...
- **Contribute to a larger deployment of coding techniques in SATCOM**
- **Identify open research issues**
 - Interaction between congestion controls and coding techniques
 - ...

Introduction

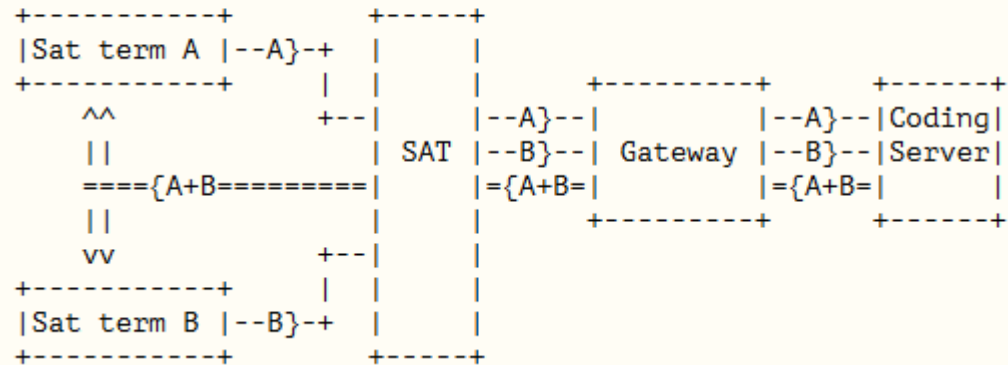
- **The notations used in this document are based on the taxonomy RFC8406**
 - Channel and link codings are gathered in the PHY layer coding and are out of the scope of this document
 - FEC (also called Application-Level FEC) operate above the network layer
 - This document considers coding (or coding techniques or coding schemes) as a linear combination and not as a content coding (e.g., to compress a video flow)
- **Active research activity on coding techniques and SATCOM**
- **Not much has actually made it to industrial developments**
- **This document aims at identifying opportunities for further usage of coding in these systems**

Note on satellite topology



Use-case: Two-way relay channel mode

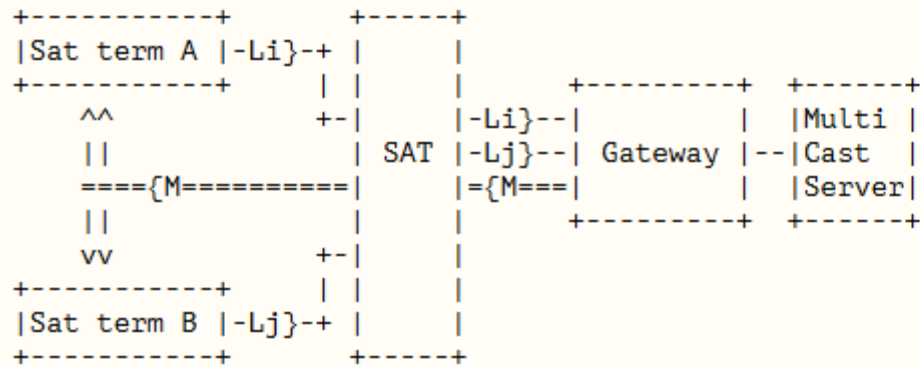
```
-X}-      : traffic from satelllite terminal X to the server
={X+Y=    : traffic from X and Y combined sent from
            the server to terminals X and Y
```



Demonstrated at ASMS2010

Use-case: Reliable multicast

-Li}- : packet indicating the loss of packet i of a multicast flow M
 =M== : multicast flow including the missing packets

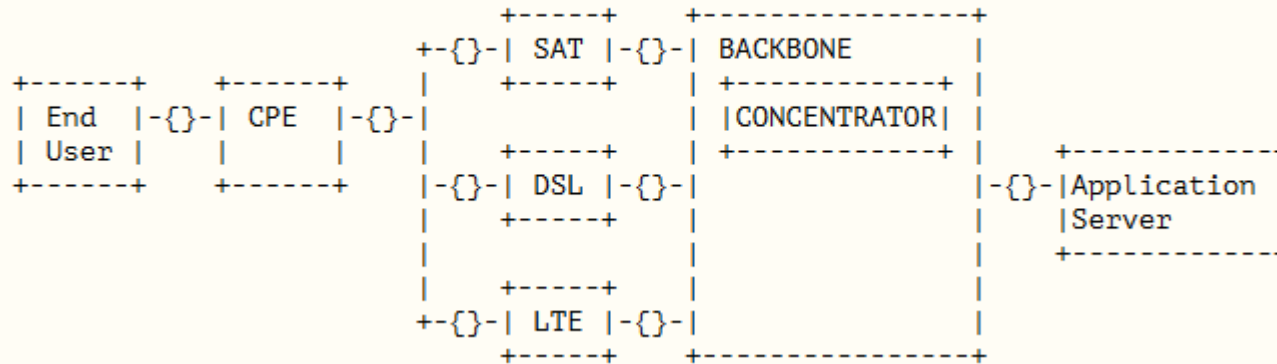


Could be achieved by using other multicast or broadcast systems, (NORM [RFC5740] in situations where a feedback link is available, or FLUTE [RFC6726] otherwise.

Note that both NORM and FLUTE are limited to block coding, none of them supporting sliding window encoding schemes [RFC8406].

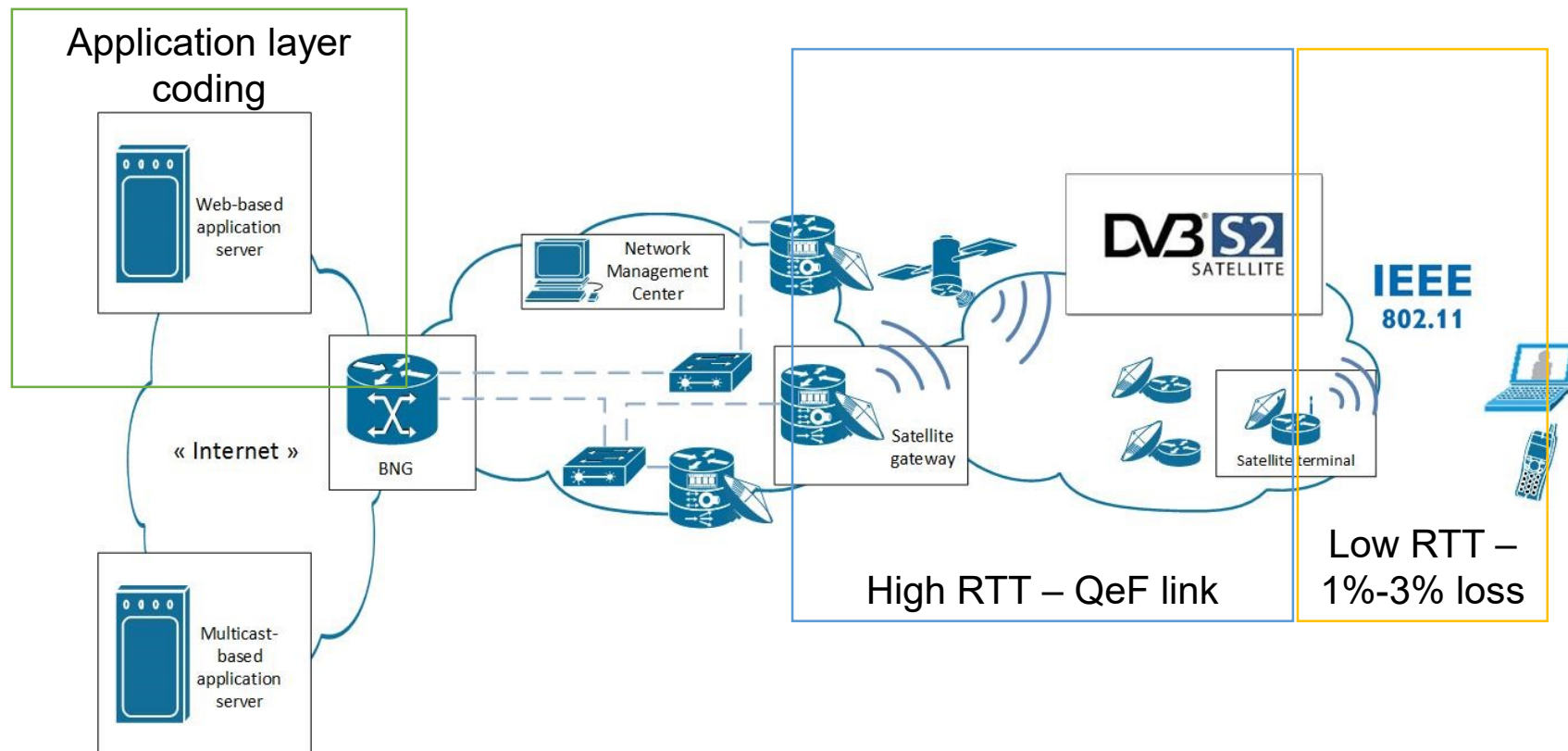
Use-case: Hybrid access

-{}- : bidirectional link



- To cope with packet loss (due to either end-user mobility or physical-layer impairments), coding techniques could be introduced both at the CPE and at the concentrator.
- Better tolerance to out-of-order packets which occur when exploited links exhibit high asymmetry in terms of RTT.

Use-case: Dealing with LAN losses

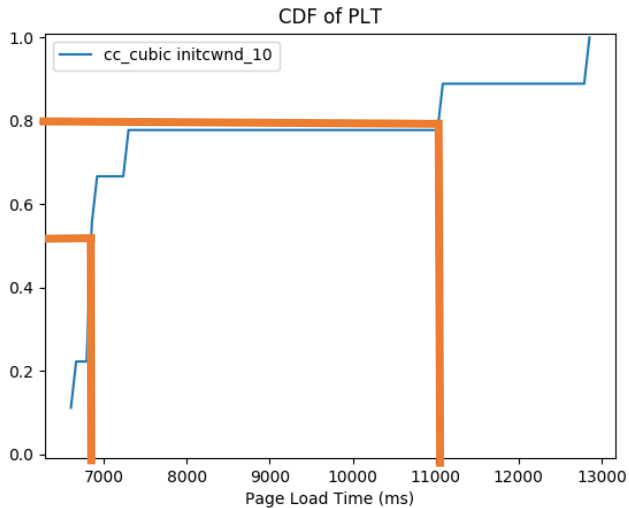


Use-case: Dealing with LAN losses

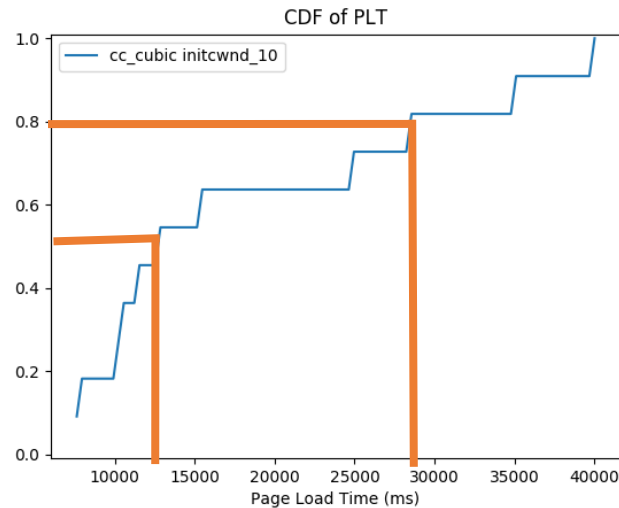


HTTP2/TCP transfer (2 MB)

PLT without congestion without losses



PLT without congestion with losses



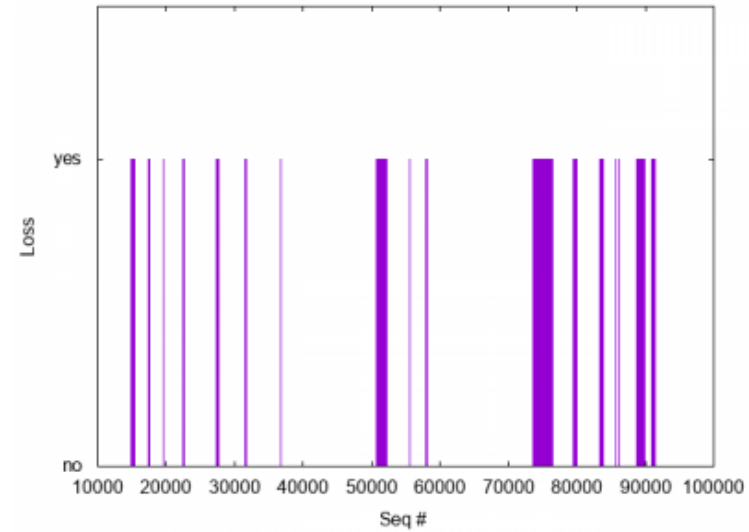
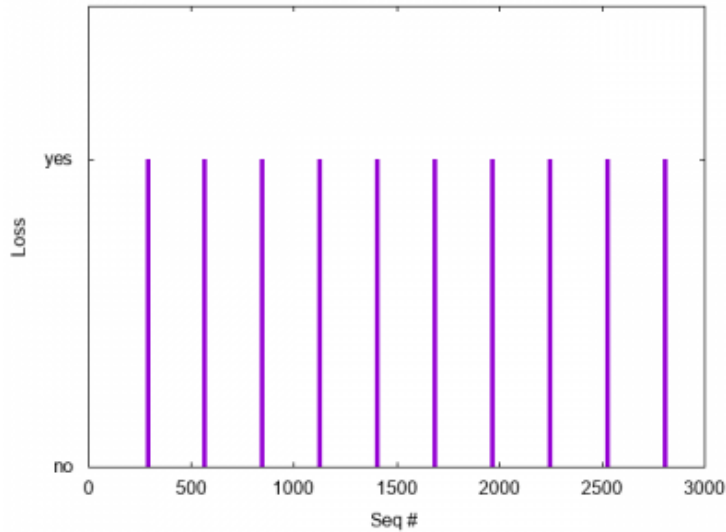
**1% losses induces
5 seconds increase (median)
18 seconds increase (80%)**

Viveris
Technologies

ThalesAlenia
a Thales / Leonardo company
Space
ekinops

Use-case: Dealing with varying channel conditions

- 3-meters antenna put on a train
- VL-SNR headers (DVB-S2X)
- C/N = 0 dB (QPSK2/9)
- LMS channel
- VL-SNR headers (DVB-S2X)
- C/N = 15 dB (QPSK11/45)



These results have been obtained with CNES SMILE project. The traces format has been adapted by Bastien Tauran (TéSA / ISAE-SUPAERO) with CNES R&T funding

Use-case: Dealing with varying channel conditions

- Optical links with fading events
- GEO-to-ground downlink scenario

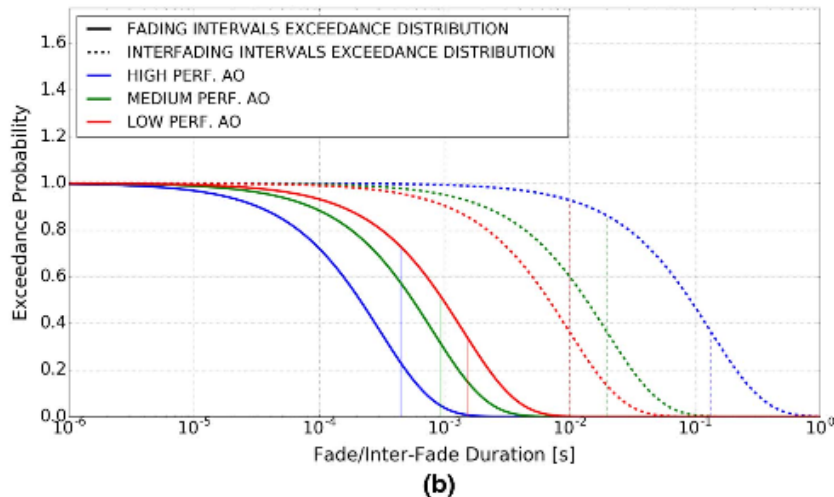
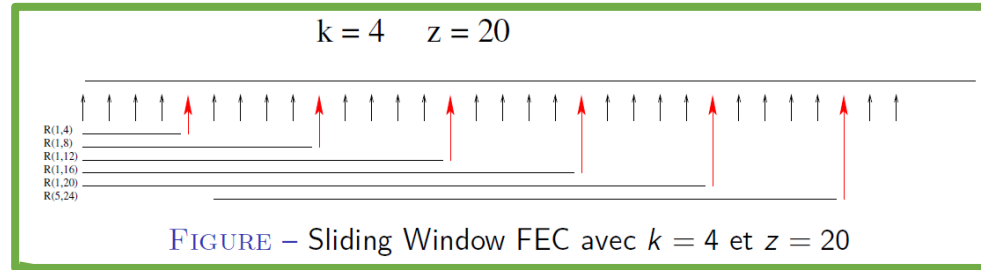


Fig. 12. Fade duration (plain lines) and interfade duration (dashed lines) analytic exceedance distributions for each AO performance level

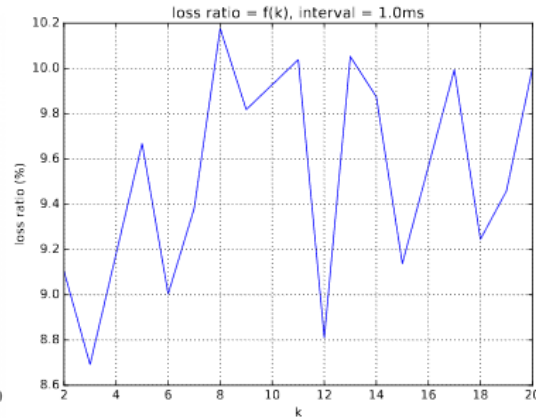
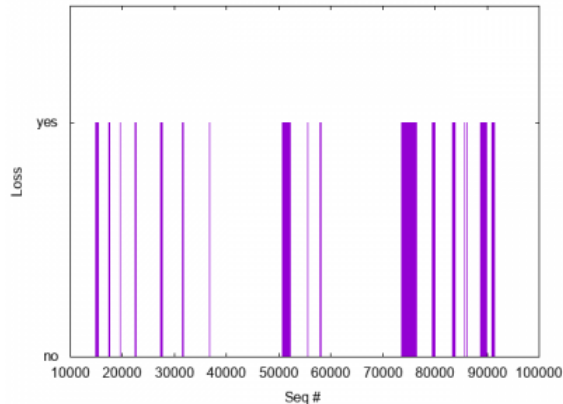
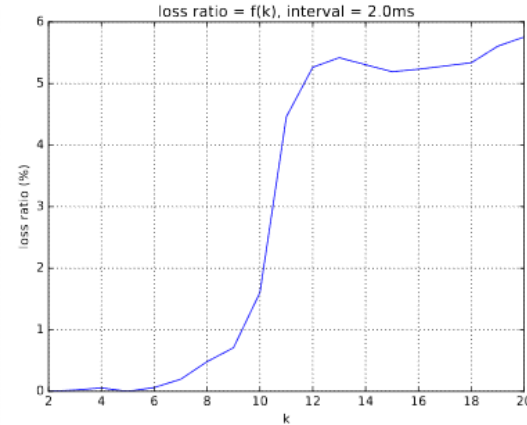
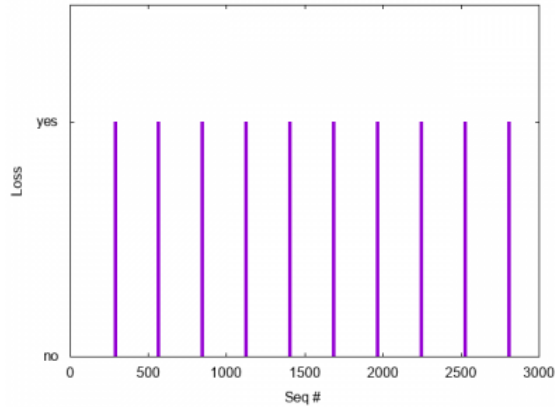
➤ There are cases where physical layer robustness is limited

Use-case: Dealing with varying channel conditions



Thanks to Bastien TAURAN, Jérôme LACAN, Emmanuel LOCHIN (TéSA / ISAE-SUPAERO) and Benjamin ROS (project funded by CNES)

Use-case: Dealing with varying channel conditions



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Research challenge : coding and congestion control

- **Coding and congestion control**
 - PEP : could host coding techniques
 - This leads to research question on the interaction between coding schemes and TCP congestion controls
 - E.g. impact of reordering level on the interest of using RACK
- **Efficient usage of resource**
 - How much overhead from redundant reliability packets can be introduced to guarantee a better end-user QoE while optimizing capacity usage ?
- **Virtualization**
 - optimization of the NFV service function chaining considering a virtualized infrastructure and other SATCOM specific functions
 - guarantee an efficient radio usage and easy-to-deploy SATCOM services
- **DTN**
 - Integration in the IETF DTN stack?

Open issues

- **Comments on virtualisation**
- **Research challenge**
 - optimization of the NFV service function chaining considering a virtualized infrastructure and other SATCOM specific functions
 - guarantee an efficient radio usage and
 - easy-to-deploy SATCOM services.
 - virtualized SATCOM terminals: management of limited buffered equipment ?

➤ Proposition to close the issue

Comments on virtualisation #12

 Open NicoKos opened this issue 28 days ago · 2 comments



NicoKos commented 28 days ago

Member + 👤 ...

I have no idea what this section means. Virtualised antennas? virtualised reflectors? Good luck with that.
chin-nfvrg-cloud-5g-core-structure-yang
referring to an expired -00 internet-draft does not add credibility.



NicoKos commented 28 days ago

Author Member + 👤 ...

MJM : But on the virtualization comment: we had presentations in the group on NFV (network virtualization) with NC for satellites. I am sure that the authors of this work could add to Lloyd's comments on that section.



NicoKos commented 27 days ago

Author Member + 👤 ...

We have added a research challenge and changed the title of section in PR #29 .
The section aims at identifying research challenge related to the interaction between NC and virtualization (function chaining, buffer management, etc).



NicoKos added the **to-be-discussed-meeting** label 27 days ago

Open issues

- **Comments on DTN**
 - **Answer**
 - The document uses DVB as a example on how to present SATCOM systems
 - No specific focus on GEO
- **Proposition to close the issue**

Comments on DTN #13

 Open NicoKos opened this issue 28 days ago · 1 comment



NicoKos commented 28 days ago

Member



legitimate -> legitimize.

This entire section is unnecessary. With this draft on a multi-gateway satellite system and DVB, you're talking about geostationary satellites which are always visible. Little disruption. 600ms or so delay is coped with by Internet protocols (RFC829 SATNET work etc.) So, not a significant delay issue either. It's out of scope for the abstract. And geostationary satellites generally don't use CCSDS for broadband; TDRSS is so much a special case.

Since we're not standards track, References aren't split informative/normative -- but given the DVB starting point, I'd expect to see more DVB-S references.

EN 302 307, which details extensions of the original satellite transmission standard DVB-S (EN 300 421), etc.



elochin commented 27 days ago

Member



We need to discuss this point. Just corrected legitimize in [#22](#)



elochin added the **to-be-discussed-meeting** label 27 days ago

From *-05 to *-06

- Next steps: WGLC?